

Application No.: 10/731,870
Attorney Docket No.: 011644-0307261

AMENDMENT TO THE CLAIMS

This listing of claims replaces all prior versions and listings of claims in this application:

1-45. (Canceled)

46. (currently amended) A water-soluble packaging film which is soluble in water at temperatures between 5 and 35° C comprising at least one polyurethane polymer, said wherein ~~the at least one polyurethane polymer comprising comprises:~~

2 to 35 weight %, based on the weight of the polyurethane polymer, of poly(ethylene oxide) groups, which have a chain length(s) corresponding to a number average molecular weight within the range of from 300 to 3,000 Daltons; and

15 to 150 millequivalents, per 100g of polyurethane polymer, of acid-functional groups wherein at least 50 weight % of the acid-functional groups are neutralized, such neutralization being with at least one base, at least part of which is at least one non-volatile base;

wherein said ~~at least~~ polyurethane polymer is a chain extended product formed using:

(A) a prepolymer component comprising an isocyanate-terminated polyurethane prepolymer, said component being formed from reactants which comprise:

- (i) at least one organic polyisocyanate,
- (ii) at least one isocyanate-reactive compound providing said poly(ethylene oxide) groups in the resulting polyurethane polymer, and
- (iii) at least one isocyanate-reactive compound providing said acid-functional groups in the resulting polyurethane polymer, and

(B) an active hydrogen component comprising at least one active hydrogen chain-extending compound.

47. (previously presented) The water-soluble packaging film according to claim 46, wherein the amount of said poly(ethylene oxide) groups ranges from 2 to 20 weight % based on the weight of the polyurethane polymer.

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48. (previously presented) The water-soluble packaging film according to claim 46, wherein the amount of said poly(ethylene oxide) groups ranges from 5 to 35 weight % based on the weight of the polyurethane polymer.

49. (currently amended) The water-soluble packaging film according to claim 46, wherein said poly(ethylene oxide) groups have a chain length corresponding to a number average molecular weight ranging from 500 to 2000 Daltons.

50. (previously presented) The water-soluble packaging film according to claim 46, wherein at least one of said poly(ethylene oxide) groups are in-chain in the polyurethane polymer.

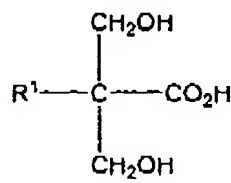
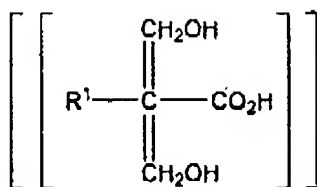
51. (previously presented) The water-soluble packaging film according to claim 50, wherein the isocyanate-reactive compound providing in-chain poly(ethylene oxide) groups is a poly(ethylene glycol).

52. (previously presented) The water-soluble packaging film according to claim 46, wherein the amount of acid functional groups present in the polyurethane polymer provides 30 to 125 millequivalents of such groups per 100 g of polyurethane polymer.

53. (previously presented) The water-soluble packaging film according to claim 46, wherein said acid functional groups are carboxylic acid or sulphonic acid groups.

54. (currently amended) The water-soluble packaging film according to claim 53, wherein the isocyanate-reactive compound providing acid functional groups is a dihydroxyalkanoic acid of formula

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where R¹ is hydrogen or alkyl.

55. (previously presented) The water-soluble packaging film according to claim 54, wherein said compound is 2,2-dimethylol propionic acid (DMPA).

56. (previously presented) The water-soluble packaging film according to claim 53, wherein the isocyanate-reactive compound providing acid functional groups is a diol bearing a sulphonic acid alkali metal salt.

57. (previously presented) The water-soluble packaging film according to claim 46, wherein the reactants for forming the prepolymer component (A) comprise at least one isocyanate-reactive compound which is monofunctional with regard to isocyanate-reactive functionality and acts as a chain-terminating material for the prepolymer.

58. (previously presented) The water-soluble packaging film according to claim 46, wherein said polyurethane polymer contains poly(propylene oxide) groups.

59. (previously presented) The water-soluble packaging film according to claim 46, wherein said active hydrogen component (B) comprises at least one active hydrogen chain-extending compound produced by the reaction of water with said prepolymer.

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60. (previously presented) The water-soluble packaging film according to claim 46, wherein said active hydrogen component (B) comprises an added active hydrogen chain-extending compound.

61. (previously presented) The water-soluble packaging film according to claim 60, wherein said added active-hydrogen chain extending compound is selected from the group consisting of a polyamine, a diamine, hydrazine, and a substituted hydrazine.

62. (previously presented) The water-soluble packaging film according to claim 60, wherein said added active hydrogen chain-extending compound is hydrazine or hydrazine monohydrate.

63. (currently amended) The water-soluble packaging film according to claim 46, wherein at least 90 weight % of the acid functional groups in the polyurethane polymer are neutralized.

64. (currently amended) The water-soluble packaging film according to claim 46, wherein at least 50 weight % of the at least one base bases used for neutralization is selected from the group consisting of Group IA monovalent metal bases, triethanolamine, 2-methyl-2-amino-1-propanol, and quaternary ammonium hydroxides.

65. (previously presented) The water-soluble packaging film according to claim 64, wherein said base is selected from the group consisting of NaOH, KOH and LiOH.

66. (previously presented) The water-soluble packaging film according to claim 46, wherein the amount of base used provides an excess of base required for the neutralization of all the acid groups, the amount of excess base remaining after neutralization being up to 10 weight % based on the weight of the water-soluble packaging film.

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67. (previously presented) The water-soluble packaging film according to claim 46, wherein the polymeric material thereof further comprises at least one other polymer which is not a polyurethane and does not detract from the water-solubility of the film.

68. (previously presented) The water-soluble packaging film according to claim 67, wherein said at least one other polymer is a polyvinyl alcohol or a neutralized carboxylic acid- or sulphonic acid-functional vinyl polymer.

69. (previously presented) A process for the production of an aqueous polyurethane polymer solution for use in the manufacture of water soluble packaging films, said polyurethane polymer comprising:

2 to 35 weight %, based on the weight of polyurethane polymer, of poly(ethylene oxide) groups which have a chain length(s) corresponding to a number average molecular weight within the range of from 300 to 3,000 Daltons; and

15 to 150 millequivalents, per 100g of polyurethane polymer, of acid-functional group; wherein at least 50 weight % of the acid-functional groups are neutralized, such neutralization being with at least one base, at least part of which is at least one non-volatile base;

said process comprising the steps of

I. synthesizing a prepolymer component comprising an isocyanate-terminated polyurethane prepolymer from reactants which comprise:

- (i) at least one organic polyisocyanate
- (ii) at least one isocyanate-reactive compound providing said poly(ethylene oxide) groups in the resulting polyurethane polymer, and
- (iii) at least one isocyanate-reactive compound providing said acid functional groups in the resulting polyurethane polymer;

II. chain extending said prepolymer component using an active hydrogen component comprising an active hydrogen chain extending compound(s) to form said polyurethane polymer; and

III. forming an aqueous solution of said polyurethane polymer,

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wherein said polyurethane polymer is capable of forming films which are soluble in water at temperatures between 5 and 35° C.